slightly elevated tubercles, a row of which, of larger size, occupies the middle line of the series, and is bordered on the outer and inner sides by smaller ones. The crown of the first molar has three middle tubercles; three external, the anterior and posterior of which are small; and two internal: the second molar has two middle, three external, and two internal tubercles: and the third molar exhibits one middle, two internal, and one posterior, tubercles.

A comparison of this description with the teeth of the *Mus Musculus*, Linn., will suffice to show that no essential difference exists between these organs in the two animals; and they consequently both belong to the same genus. The *cranium* of *Mus Barbarus*, it may be added, is comparatively more elongated than that of *Mus Musculus:* its length is one inch and three lines; its greatest breadth, six lines; its breadth between the orbits, two lines and a half; and the width of the zygomatic arches nearly eight lines.

The accompanying figure, Tab. xvii, was taken from one of the specimens at present living in the collection of the Zoological Society.

Art. LX. *Notice of Ceratitis Citriperda, an Insect very destructive to Oranges. By* W. S. MacLeay, *Esq., A.M., F.L.S., &c., in a Letter to the Editor.*

My dear Vigors,

It argues but little acquaintance with the gratification that may be derived from the study of Natural History, to confine our researches within what we may deem to be the sphere of its practical utility. The Naturalist is the Historian of facts; and to him it ought little to matter whether these facts be of apparent utility or not. It is his duty to record them all, because he can never be sure that any are to remain absolutely without importance, or that some one of his successors in the science may not have occasion to make use of them. If even he should be fortunate enough to make a new observation, having an immediate bearing on the common purposes of life, he is not to suppose that he

has therein fulfilled the great object of Natural History, or indeed that scientifically he has more merit than another, whose researches, provided they may be accurate, are not of utility so visible. Were we once to concede any such principle, a great portion of facts, which however uninteresting to the world at large, are at the same time absolutely necessary for the Naturalist to know, would thus be neglected, and when we came to study the noblest and most interesting branch of our science, the progression of natural affinities, we should find ourselves without data to proceed upon.

I even think it may be easily shewn that the study of Zoology has not been so immediately beneficial to the ordinary interests of mankind as it would have been, had persons looked less anxiously to the *cui bono*, and more accurately to apparently useless facts that lay within their observavation. To take one most obvious example; it is apparently of little import to our domestic comfort that insects should be subject to metamorphosis, and therefore this metamorphosis remains a fact scarcely known to the generality of those individuals, who, from their professions or mode of life, are often most subject to their ravages, although of all points of insect history, it is a knowledge of their metamorphosis that in most cases offers us the best hope of counteracting the evils these little animals inflict.

It may seem needless to make these common-place remarks to the Editor of a Journal, which has originated in similar views of Natural History, and the very object of which is to record and perpetuate the knowledge of facts, that without some such protecting influence would soon sink into oblivion. If, therefore, I have been led to decry the force of the most vulgar of the various objections that have been brought against Entomologists, it is that none of your readers may imagine, because an insect may be minute (such as the very one, of which, as destructive to oranges, I propose giving the following account) that therefore it is unworthy to occupy attention; and that still less any of them may think, that when an insect is proved to be destructive, all investigation ought to cease with the knowledge of this bare fact. The only reward the Naturalist ought to look for, is the delight which the study affords, and this proceeds from the examination of an *Aphis* as well as from that of a *Limulus*.

The quantity of oranges annually imported into England, amounts to about from 90,000 to 100,000 chests, of which the greatest part comes from the Azores. Of the quantity imported, however, only about two-thirds are of use, as the orange-merchants calculate on a total loss of one-third of their average importations; and indeed it frequently happens that whole cargoes arrive in such a state of decay as not even to sell for the value of their freight, so that the London merchant, if not insured, incurs, in addition to this loss, all that of the first cost and shippers' charges. As, however, he calculates on the sound cargoes making up the loss, and leaving him a profit on the whole of his importations, it is clear that the real burden falls on the public, who are thus obliged to pay nearly a third more for the oranges they consume, than they would do on the supposition of the cargoes remaining sound. When it is considered that this increase of price affects one of the most esteemed and refreshing of fruits, it becomes a matter of some little interest to investigate the causes of their decay, and if possible to remedy it. A great object will indeed be gained, if we can point out any one of these causes, inasmuch as the first great step towards removing an evil is to understand thoroughly its cause. I believe the prevalent idea on the subject to be, that the arrival of a cargo of oranges in an unsound state results from their being, while on the voyage, necessarily stowed away where there can be no free circulation of air; and without doubt where decay has once begun, it cannot fail to be hastened by this circumstance. It is, however, easy to perceive, that were this the sole cause in which the decay of oranges originates, all cargoes on their arrival would be nearly in the same state, whereas orange-merchants experience not only that some arrive totally destroyed, and others wholly sound, but that the soundness of the cargo varies with the season, and even with the year. Thus the decay of oranges was much greater in 1822 than in 1823, and it was again much more considerable in 1824. Making all due allowance, therefore, for the effect of the heated and confined air in the hold of a vessel, I conceive the mischief to originate chiefly in the oranges being unsound when shipped; for a general remark made by the orange-merchants is, that the St. Michael oranges rot much sooner than those from other parts of the world, and that the average proportion of decayed

oranges is much greater from St. Michael's than from Lisbon, differences that can scarcely be supposed to result from their voyage to England. Now the decay of the St. Michael oranges, which form the great bulk of those brought to the London market, is towards the end of their season, namely, during the months of March, April, and May, almost universally accompanied by the presence of the larva of a small fly, which I shall shew by observations made by a friend in the Isle of France, and by myself in London, to be the cause of the evil. Whether the Lisbon oranges suffer from any similar insect, I have not been able accurately to ascertain, but sure it is that the general symptoms of decay are much the same in both cases, so that there is at least great reason to suspect it. As for the St. Michael oranges, towards the end of the season whole chests are destroyed by this fly, specimens of which are easy to be procured, as they may be bred from the larvæ which are to be found in almost every one of those damaged oranges which our barrow-women display for sale in the month of May. Those worthy collectors, however, that confine their attention to British insects, need not place it in their cabinets, as I find they have of late been doing with American forms. At least they must first shew the orange-tree itself to be indigenous.

On a first view of the subject, it would appear, that if oranges are shipped in a damaged state, it must be certainly known to the shipper; but there is no good reason to believe that any such advantage is taken of the London merchant, since oranges as frequently arrive in a damaged state, when on account of the shipper, as when to the order of a merchant. The truth is, that both parties being able to shift the burden from off their own shoulders, it is a matter of comparatively little concern to them what may be the cause of a general evil, and this cause being moreover, in its nature, of that sort which requires a minute investigation, it is not to be wondered at that it should have so long remained unknown. I ought, however, here to state, that Mr. Trevelyan having given my father some specimens of the insect, I was induced by the singularity of its form to consult Mr. Mart of Oxford Street, the respectable orange merchant who had called Mr. Trevelyan's attention to the subject. It would therefore be a great injustice to Mr. Mart, if I did not give him the full credit of having discovered the fly which is the

cause of the decay in oranges, and if I did not thank this gentleman, as well as Mr. Adams of Thames Street, for the valuable information on the subject, which their profession has enabled them to give me.

In the third volume of M. Cuvier's Règne Animal, page 647, M. Latreille makes the following remark under the head of *Tephritis*. "Les Colons de l'Isle de France ne peuvent presque pas, d'après des "observations que m'a communiquées M. Cattoire, obtenir des Citrons "sains et en parfaite maturité à raison de l'extrême multiplicité d'un dip-"tère du même sousgenre qui y depose ses œufs." To the kindness of M. Cattoire who was formerly Paymaster of the French forces in the Mauritius, I hold myself indebted for a female specimen of this insect, which he says attacks the *oranges* and not the limes; but as the note which he gave me affixed to the insect differs still more materially from the above statement of M. Latreille I cannot do better than to copy it *verbatim*. "Cet Insecte depose sa larve dans l'ovaire de la fleur d'Oran-"ger, et en detruit le fruit." I shall shew at some future opportunity, how little difference exists between this insect from the Mauritius, and that which attacks the oranges of St. Michael. In the mean while I shall merely observe, that the above few words of M. Cattoire, the only observer as yet of the insect's economy on the spot, are evidently hastily expressed, and do not coincide with the above information, which M. Latreille professes to have derived from him. And indeed it is almost impossible to believe on examining a decayed orange from St. Michael's that the parent fly deposited its egg in the flower, and not in the fruit, as the original puncture of its ovipositor remains visible in the centre of the soft part of the rind, and is the invariable proof of a maggot being the cause of the decay of the orange. In weighing therefore the degrees of credit for accuracy which ought to be attached to these conflicting statements, namely, that of M. Cattoire to me, and that of M. Latreille, as given on M. Cattoire's authority, I am inclined to agree with the former, that the fruit attacked in the Mauritius is the orange and not the lime, because the insect is scarcely more than a variety of the St. Michael species; and I am induced to place confidence in M. Latreille's statement, that the parent insect deposits its egg in the fruit, because in like manner this is obvious from the appearance of the infected St. Michael oranges

which always exhibit the puncture, by which the fly inserted its destructive offspring.

Whenever this puncture appears in an orange, we may be sure, I repeat, that there is a worm concealed in the interior; and a little attention therefore to this circumstance on the part of the packers at St. Michael's, might prevent so many unsound oranges being shipped. The orange merchants, as I have before said, find that certain cargoes are wholly infected with this insect, while others are almost untouched, that one year the oranges are very subject to it, and another year scarcely at all; the whole of which evidently corresponds with what every Entomologist knows from experience to be probable, namely, that the perfect insect or imago is particularly prevalent at particular times, in particular districts. It is difficult, however, to say what the districts or seasons are in which this fly is most prevalent at St. Michael's; but as the continuation of the evil evidently depends on the oranges consumed in the Island, one can easily imagine that the havoc is not entirely without remedy. The examination for two or three consecutive years of all the fruit as soon as plucked, and the immediate destruction of all such as contained larvæ, would, if it did not entirely eradicate the species, at least diminish its influence to an amount that would render it altogether inconsiderable. When Horticulturists complain of the mischief done to their ripe fruit by the larvæ of insects, they have themselves in a great measure to blame, since the facility of lessening the numbers of such species is great indeed when compared with that of protecting the tree itself, or even the blossom, from the injury which other insects inflict. But if the fruit be either left too long on the tree, or if when plucked it should be left unexamined, so as to allow the perfect insect to emerge in safety, and propagate the evil, while the fruit itself is almost of no value, we must not be surprized at the result. With respect to the St. Michael oranges, did the loss fall on the proprietors of the orange-groves, or even on the shippers, it would be their interest to pay some attention to an insect by which the public at present suffer so much; and strict attention on their part during the spring of two or three consecutive years, to the appearance of the ripe fruit consumed in the Azores, which, according to Dr. Webster, amounts to about 40,000 chests, and the careful destruction in proper

time of the worthless oranges, which are punctured in the above-mentioned manner, would serve at least to diminish the evil, if not entirely to eradicate it.*

I shall now describe more particularly the appearance of an infected orange, which may be at once known by a greater or less portion of its rind being withered, and shewing evident symptoms of decay, in having lost its firm consistency and texture, and in having changed the usual brilliancy of its colour for an opaque and dull olive yellow. The size of this withered and discoloured spot must of course, in a great measure, depend on the havoc committed in the orange by the concealed insect. While, however, the fly is in its larva state, this spot appears to vary from a space that might be covered with a sixpence, to one that might be covered with half-a-crown. In the centre we may perceive a small white orifice, which is the puncture of the parent insect, and which in general may be distinguished with ease from the orifice made by the larva previous to metamorphosis by a certain whiteness of the sides, which appears to result from some mould or other vegetable of that nature.

On opening such a fruit as has just been described, we discover the whole space from the discoloured spot to the core to be in a state of perfect decay, the juice having disappeared, and the fibres being completely decomposed, and covered in a greater or less degree with that blue and white mould which is usual in decayed oranges. The rest of the orange is generally entire, but so desiccated as most imperfectly to represent that pulpy substance, which in a good St. Michaels' fruit is so replete with juice. It is revelling in the decayed part of the orange that we find the larva of our fly, which, when of sufficient maturity to emerge from it, undergoes its coarctate metamorphosis outside the fruit.

I became acquainted with this insect in its various states, in 1822, when I made my drawings and dissections of it. One of these drawings, which is that of the male in its imago state, highly magnified, I herewith send you to accompany the publication of this notice. At that time I found that I could not proceed on any generalizing anatomical principle with the

* I ought, however, to observe, that I have seen the perfect fly on a heap of oranges in the market-place of Funchal, in the Island of Madeira, and also in St. Jago, one of the Capeverds. I am informed, moreover, that a maggot infests oranges in the West Indies, but I have not myself yet seen it.

description of what I had observed, without inventing a number of new terms, which, to me at least, is a most odious office. As I understood that such terms were soon about to be proposed to the scientific world, I was induced to wait for their publication, and to let my drawings and observations of the above fly to lie at rest for a while in my portfolio, together with a paper on the wings of *Diptera*, which had been read to the Zoological Club of the Linnean Society. As, however, I find myself remaining in much the same state of inability to describe what I have observed, and that there is still sufficient room left for my lucubrations, I shall transmit to you, from time to time, a rather extensive series of remarks on the above order of insects. For the present I request you merely to let naturalists be aware of the existence of such an insect as *Ceratitis Citriperda*, the male of which is most remarkable in an entomological point of view, for having two clavate subarticulate horns planted between the eyes, so as to make the insect appear provided with two anomalous antennæ in addition to its regular pair. The female is without these singular appendages. *Ceratitis* is a genus that differs from *Tephritis* in the nervures of the wings, as well as in the above remarkable structure of the male, which, by the bye, does not appear to have been noticed by M. Cattoire. The colour of the eyes, when alive, is brilliantly metallic, as in most of the *Tephritidæ*, but being violet, is exquisitely beautiful, and different from the hue of the eyes in any other dipterous insect I have seen. I shall give you the characters of this genus at length in a future paper, where I shall enter more deeply into the subject of the little understood order of *Diptera*.

Yours ever most truly,

W. S. MacLeay.